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HIGHLIGHTED ARTICLES

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Assessment of contaminant concentrations in California mussels (*Mytilus* spp): relationship to land-use and outfalls

Consumption by marine mammals on the Northeast US continental shelf

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Assessing the relative importance of local and regional processes on the survival of a threatened salmon population

The legacy of a crowded ocean: indicators, status, and trends of anthropogenic pressures in the California Current ecosystem

At-sea factors that affect yellowfin tuna grade in the Gulf of Mexico pelagic longline tuna fishery

Larval source contributions of Pacific cod (*Gadus macrocephalus*) recruits in the southeastern Bering Sea

The impact of best track discrepancies on global tropical cyclone climatologies using IBTrACS

Acoustic evidence that harbor porpoises (*Phocoena phocoena*) avoid bottlenose dolphins (*Tursiops truncatus*)

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HIGHLIGHTED ARTICLES

Vulnerability of oceanic sharks as pelagic longline bycatch
Global Ecology and Conservation
A. J. Gallagher, **E. S. Orbesen**, N. Hammerschlag, and **J. E. Serafy (NMFS/SEFSC)**

- Both NMFS-protected and unprotected pelagic shark species (12 total) were examined for their relative tolerance to longline fishing stress.
- Species-specific survival (at gear retrieval) estimates after controlling for a suite of operational, environmental and biological factors.
- When survival estimates were integrated with reproductive traits, night, dusky and bigeye thresher sharks emerged as the most vulnerable, a finding broadly consistent with International Union for the Conservation of Nature's "Endangered" category.

Bycatch (the unintentional catch of non-target species or sizes) is consistently ranked as one of the greatest threats to marine fish populations worldwide; yet species-specific rates of bycatch survival are rarely considered in risk assessments. Regulations often require that bycatch of threatened species be released; but, if animals are already dead, their release serves little or no conservation purposes. The authors examined the survival of 12 shark species caught as bycatch in the US Atlantic pelagic longline fishery. Shark survival was evaluated in relation to fishery target (swordfish versus tuna) and four operational, environmental, and biological variables to evaluate the underlying mechanisms driving mortality. Survival estimates ranged from 33% (night shark) to 97% (tiger shark) with seven of the 12 species being significantly affected by at least one variable. Higher survival was evident in tuna sets for six species. The authors placed survival results within a framework that assessed each species' overall index of relative vulnerability by integrating survival estimates with species-specific reproductive potential (age at maturity and fecundity). The bigeye thresher, dusky, night, and scalloped hammerhead shark exhibited the highest vulnerabilities to bycatch. The Authors conclude that results of these assessments mirror the IUCN Red List categories for most species and suggest that pelagic longlines affect species differentially. The authors suggest that considering ecological and biological traits, in addition to survival rates and life-history parameters, may be useful in designing effective conservation measures, and techniques that reduce fisheries interactions in



the first place may be the best strategy for mitigating bycatch mortality for highly vulnerable species.
Acceptance date: 20 June 2014

*Assessment of contaminant concentrations in California mussels (*Mytilus *spp): relationship to land-use and outfalls*
Marine Pollution Bulletin
M. A. Edwards, A. P. Jacob, K. L. Kimbrough, E. Davenport, and **E. Johnson (NOS/NCCOS)**

- This manuscript emphasizes the necessity for continued monitoring of legacy contaminants that still pose a threat, including those contaminants that were banned decades ago.
- The incorporation of land-use assessment and practices in monitoring programs has been shown to be invaluable, and as a result, will enable coastal managers and stakeholders to gain a better understanding of the relationship and dynamics between contaminant concentrations and their association with land-use and outfalls.
- The above assessment strategies and tools can enable coastal managers to develop and improve techniques in understanding and addressing coastal pollution, including contaminant concentrations. Importantly, coastal managers can be better equipped in fine tuning future regional and national assessments plans as they move towards using land-use and outfall monitoring dataset for contamination prediction and forecasting, as well as for guiding development of management and mitigation/remediation activities and programs as the need arise.

NOAA's Mussel Watch Program funded a regional pilot project in California that characterized contaminants associated with various land uses in conjunction with state, federal and private partners. In this paper, the authors assess the magnitude and distribution of trace elements and persistent organic contaminants in indigenous mussels with respect to land-use, presence of outfalls and a subset of California Areas of Biological Significance (ASBS). The authors detected significant differences among the land-use categories for the majority of trace elements and legacy contaminants measured. There was no significant difference between sites with and



without outfalls. PCBs and PAHs were significantly lower in sites within ASBS boundary compared to other sites. The findings of this study will help fine tune future regional and national assessments as well as guide development of resource management and remediation activities and programs.
Expected publication date: Summer 2014

Consumption by marine mammals on the Northeast US continental shelf
Ecological Applications
L. A. Smith, J. S. Link, S. X. Cadrin, and **D. L. Palka (NMFS/NEFSC)**

- Predation by 12 marine mammal species on 12 prey groups was estimated for the Northeast US continental shelf region, and uncertainty was included.
- Consumption of commercially important prey groups by marine mammals was generally similar in magnitude or higher than fisheries removals for those prey species.
- This work highlights the importance of considering marine mammal consumption as a source of mortality in assessments of prey stocks, and suggests that marine mammal consumption should be a factor incorporated into ecosystem models

The economic and ecological impacts of fish consumption by marine mammals, the associated interactions with commercial fish stocks, and the forage demands of these marine mammal populations are largely unknown. Consumption estimates are often either data deficient or not fully evaluated in a rigorous, quantitative manner. Although consumption estimates exist for the Northeast US (NEUS) Large Marine Ecosystem, there is considerable uncertainty in those estimates. We examine consumption estimates for twelve marine mammal species inhabiting the regional ecosystem. We used sensitivity analyses to examine metabolically-driven daily individual consumption rates resulting in a suite of feasible parameter-pair ranges for each of three taxonomic groups: mysticetes, odontocetes and pinnipeds. We expanded daily individual consumption to annual consumption based on abundance estimates of marine mammals found on the NEUS continental shelf coupled with estimates of annual residence time for each species. To examine consumptive removals for specific prey, diet compositions were summarized into major prey categories and predatory removals by marine mammal species as well as for total marine mammal consumption were estimated for each prey taxa. Bounds on consumption



estimates for each marine mammal species were determined using Monte Carlo resampling simulations. Our results suggest that consumption for these twelve marine mammal species combined may be similar in magnitude to commercial fishery landings for small pelagic and groundfish prey groups. Consumption by marine mammals warrants consideration both as a source of mortality in assessments of prey stocks, and to determine marine mammal forage demands in ecosystem assessment models. The approach we present represents a rigorous, quantitative method to scope the bounds of the biomass that marine mammals are expected to consume, and is appropriate for use in other ecosystems where the interaction between marine mammals and commercial fisheries is thought to be prominent.
Acceptance date: 29 April 2014

ADDITIONAL ARTICLES

Assessing the relative importance of local and regional processes on the survival of a threatened salmon population
PLoS ONE
J. A. Miller, **D. J. Teel, W. T. Peterson,** and A. M. Baptista **(NMFS/NWFSC)**

- Strong evidence of growth-mortality hypothesis for Snake River spring/summer Chinook salmon studied during juvenile ocean phase marine growth.
- Biological indices such as juvenile salmon catch-per-unit-effort and a copepod community index were used to predict survival and accounted for substantial variation in survival.

Research on regulatory mechanisms in biological populations often focuses on environmental covariates. An integrated approach that combines environmental indices with organismal-level information can provide additional insight on regulatory mechanisms. Survival of spring/summer Snake River Chinook salmon (*Oncorhynchus tshawytscha*) is consistently low whereas some adjacent populations with similar life histories experience greater survival. It is not known if populations with different survival rates respond similarly during early marine residence, a critical period in the life history. The authors combined ocean collections, genetic stock identification, and otolith analyses to evaluate the growth-mortality and match-mismatch



hypotheses during early marine residence of spring/summer Snake River Chinook salmon. Interannual variation in juvenile attributes, including size at marine entry and marine growth rate, was compared with estimates of survival and physical and biological metrics. Multiple linear regression and multi-model inference were used to evaluate the relative importance of biological and physical indices in explaining interannual variation in survival. Results indicate that there was relatively weak support for the match-mismatch hypothesis and stronger evidence for the growth-mortality hypothesis. Marine growth and mean size at capture were strongly, positively related with survival, a finding similar to spring Chinook salmon from the mid-upper Columbia River. In hindcast models, basin-scale indices (Pacific Decadal Oscillation (PDO) and the North Pacific Gyre Oscillation (NPGO)) and biological indices (juvenile salmon catch-per-unit-effort (CPUE) and a copepod community index (CCI)) accounted for substantial and similar portions of variation in survival for juvenile emigration years 1998-2008 ($R2 > 0.70$). However, in forecast models for emigration years 2009-2011, there was an increasing discrepancy between predictions based on the PDO (50-448% of observed value) compared with those based on the NPGO (68-212%) or biological indices (CPUE and CCI: 83-172%). Overall, the PDO index remains remarkably informative but other basin-scale and biological indices provided more accurate indications of survival in recent years.
Publication date: 14 June 2014

The legacy of a crowded ocean: indicators, status, and trends of anthropogenic pressures in the California Current ecosystem
Environmental Conservation
K. S. Andrews, **G. D. Williams**, **J. F. Samhouri**, **K. N. Marshall**, **V. V. Gertseva**, and **P. S. Levin (NMFS/NWFSC)**

- Human demands on marine resources are increasing, and with it our need to understand the impacts of these pressures.
- We developed indicators and quantified the status and trends of 22 anthropogenic pressures acting on the California Current Large Marine Ecosystem, and reduced this to four common trends for this ecosystem.



- These data will help incorporate the effects of multiple human activities into management frameworks and help determine the impacts of anthropogenic pressures on the California Current ecosystem.

As human population size and demand for seafood and other marine resources increase, understanding the influence of human activities in the ocean and on land becomes increasingly critical to the management and conservation of marine resources. In order to account for human influence on marine ecosystems while making management decisions, linkages between various anthropogenic pressures and ecosystem components need to be determined. Those linkages cannot be drawn until we know how different pressures have been changing over time. Here, we identified indicators and developed time series for 22 anthropogenic pressures acting on the U.S. portion of the California Current ecosystem. Time series suggest that seven pressures have decreased and two have increased over the short term, while five pressures were above and two pressures were below long-term means. Cumulative indices of anthropogenic pressures suggest a slight decrease in pressures in the 2000's compared to the preceding few decades. Dynamic factor analysis revealed four common trends that sufficiently explained the temporal variation found among all anthropogenic pressures. Using this reduced set of time series will be useful when trying to determine whether links exist between individual or multiple pressures and various ecosystem components.
Publication date: Summer 2014

At-sea factors that affect yellowfin tuna grade in the Gulf of Mexico pelagic longline tuna fishery
Fisheries Research
D. G. Foster, G. R. Parsons, **D. Snodgrass** and A. Shah **(NMFS/SEFSC)**

- This study examines how at-sea factors, including the capture process, affect the quality of yellowfin tuna, *Thunnus albacares* caught in the northern Gulf of Mexico pelagic longline fishery.
- The results demonstrate that elapsed time on the hook, tuna length and fish boarded alive are positively correlated with the proportion of tuna graded as high, while number of days on ice is negatively correlated with tuna grade.



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Burnt tuna syndrome (BTS) is a term used to describe changes in raw tuna (sashimi) that is characterized by pale color, poor texture, and an "off" flavor. This reduction in tuna quality results in a much lower price for the fisher and significantly affects the profitability of tuna fisheries. In this study, we examine how at-sea factors, including the capture process, affect the quality of yellowfin tuna, *Thunnus albacares* caught in the northern Gulf of Mexico pelagic longline fishery. Hook timers were used to record the elapsed time between a tuna taking the hook and its eventual landing. The elapsed time on the hook, tuna length and fish boarded alive was found to be positively correlated with the proportion of tuna grading high, while days on ice was found to be negatively correlated.
Accepted: June 2014

*Larval source contributions of Pacific cod (*Gadus macrocephalus*) recruits in the southeastern Bering Sea*
Deep Sea Research II
J. Miller, R. DiMaria, and **T. P. Hurst (NMFS/AKFSC)**

- Studies spawning locations of Pacific cod (*Gadus macrocephalus*) in the southeastern Bering Sea.
- Discovers that elemental variation otolith chemistry is sufficient to use as a tracer of dispersal and movement patterns in Bering Sea Pacific cod.
- The observation of limited mixing between spawning and nursery areas suggests that focused harvest of specific spawning aggregations could alter patterns of nursery habitat usage.

Effective and sustainable management depends on knowledge of spawning locations and their relative contributions to marine fish populations. Pacific cod (*Gadus macrocephalus*) in the southeastern Bering Sea aggregate at discrete spawning locations but there is little information on patterns of larval dispersal and the relative contribution of specific spawning areas to nursery habitats. Age-0 Pacific cod from two cohorts (2006 and 2008) were examined to address the following questions: (1) does size, age, and otolith chemistry vary among known capture locations; (2) can variation in elemental composition of the otolith cores (early larval signature) be used to infer the number of chemically distinct sources contributing to juvenile recruits in the



Bering Sea; and (3) to what extent are juvenile collection locations represented by groups of fish with similar chemical histories throughout their early life history? Hierarchical cluster (HCA) and discriminant function analyses (DFA) were used to examine variation in otolith chemistry at discrete periods throughout the early life history. HCA identified five chemically distinct groups of larvae in the 2006 cohort and three groups in 2008; however, three sources accounted for 80-100% of the juveniles in each year. DFA of early larval signatures indicated that there were non-random spatial distributions of early larvae in both years, which may reflect interannual variation in regional oceanography. There was also a detectable and substantial level of coherence in chemical signatures within groups of fish throughout the early life history. The variation in elemental signatures throughout the early life history (hatch to capture) indicates that otolith chemical analysis could be an effective tool to further clarify larval sources and dispersal, identify juvenile nursery habitats, and estimate the contributions of juvenile nursery habitats to the adult population within the southeastern Bering Sea.
Accepted: 14 June 2014

The impact of best track discrepancies on global tropical cyclone climatologies using IBTrACS
Monthly Weather Review
C. J. Schreck (CICS-NC), **K. R. Knapp**, and **J. P. Kossin (NESDIS/NCDC)**

- This study compares two of the most readily available global datasets that are combinations of: 1) WMO-sanctioned tropical cyclone warning centers (IBTrACS-WMO) and 2) US agencies (NHC+JTWC).
- NHC+JTWC winds are generally higher than those from IBTrACS-WMO, even after some modest adjustments.
- This study shows that discrepancies between the two datasets in the west Pacific project onto global totals of tropical cyclone activity because 30% of the world's tropical cyclones form in that basin.

Using the International Best Track Archive for Climate Stewardship (IBTrACS), the climatology of tropical cyclones was compared between two global "best track" datasets: 1) the World Meteorological Organization (WMO) subset of IBTrACS (IBTrACS-WMO) and 2) a combination of data from the National Hurricane Center and the Joint Typhoon Warning Center



(NHC+JTWC). Comparing the climatologies between IBTrACS-WMO and NHC+JTWC highlights some of the differences inherent in these datasets for the period of global satellite coverage 1981-2010. The results demonstrated the sensitivity of these climatologies to the choice of best track dataset. Previous studies have examined best-track heterogeneities in individual regions, usually the North Atlantic and West Pacific. This study puts those regional issues into their global context. The differences between NHC+JTWC and IBTrACS-WMO are greatest in the West Pacific where the strongest storms are substantially weaker in IBTrACS-WMO. These disparities strongly affect the global measures of tropical cyclone activity because 30% of the world's tropical cyclones form in the West Pacific. Because JTWC employs similar procedures throughout most of the globe, the comparisons in this study highlight differences between WMO agencies. For example, NHC+JTWC has more 96-kt storms than IBTrACS-WMO in the West Pacific but fewer in the Australian region. This discrepancy probably points to differing operational procedures between the WMO agencies in the two regions. Without better documentation of historical analysis procedures, the only way to remedy these differences will be through systematic reanalysis.
Accepted: 19 June 2014

*Acoustic evidence that harbor porpoises (*Phocoena phocoena*) avoid bottlenose dolphins (*Tursiops truncatus*)*
Marine Mammal Science
E. K. Jacobson, **K. A. Forney**, and J. T. Harvey **(NMFS/SWFSC)**

- This study demonstrates the utility of passive acoustic data for documenting interspecies interactions.
- The authors provide evidence that harbor porpoise are responding behaviorally to bottlenose dolphin aggression in central California.

In California, harbor porpoise (*Phocoena phocoena*) and common bottlenose dolphin (*Tursiops truncatus*) distributions overlap in a narrow coastal band. Interspecies aggression has been observed in California and in other regions where these species coexist. The authors investigated whether the documented conflict between bottlenose dolphins and harbor porpoise in California impacted harbor porpoise echolocation behavior where habitat overlap with



bottlenose dolphins occurs. They used moored porpoise click detectors (C-PODs) to quantify relative presence of harbor porpoise and bottlenose dolphins at a study site in Monterey Bay, California, U.S.A. From October to December 2011, the authors collected 2016 hours of automated acoustic click train detections. They found that harbor porpoise acoustic activity at our study site decreased markedly when bottlenose dolphins were acoustically present. To quantify this response while controlling for potential habitat-related variation, the authors modeled harbor porpoise acoustic activity, measured as the hourly count of porpoise positive minutes, as a function of water temperature and bottlenose dolphin acoustic presence. They used a two-part zero-inflated negative binomial model and selected the best model using Akaike's information Criterion. Zeros were predicted by water temperature, dolphin presence, and their interaction ($p = 0$ for all), while counts were predicted by temperature ($p < 0.05$) and dolphin presence ($p = 0$). The model predicted that when bottlenose dolphins were present, harbor porpoise acoustic activity would be reduced by half at relatively low temperatures and by 2/3 at higher temperatures compared to when bottlenose dolphins were absent. This result indicates that harbor porpoise may passively detect bottlenose dolphin vocalizations and respond by decreasing echolocation rates or by leaving the area. These possible behavioral responses to the threat of bottlenose dolphin aggression may reduce harbor porpoise fitness as a result of exclusion from suitable habitat in the nearshore environment or reduced foraging success when bottlenose dolphins are present.
Accepted: 12 June 2014

Marine ecosystem regime shifts: challenges and opportunities for ecosystem-based management
Philosophical Transactions Royal Society of London
P. S. Levin (NMFS/NWFSC), and C. Möllmann

- The authors suggest how to apply Integrated Ecosystem Assessment (IEA) for dramatic cases of regime shifts and discuss shortcomings in current methods.
- An IEA uses approaches that determine the likelihood that ecological or socio-economic properties of systems will move beyond or return to acceptable bounds as defined by resource managers and policy makers.



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Regime shifts have been observed in marine ecosystems around the globe. These phenomena can result in dramatic changes in the provision of ecosystem services to coastal communities. Accounting for regime shifts in management clearly requires integrative, ecosystem-based management (EBM) approaches. EBM has emerged as an accepted paradigm for ocean management worldwide, yet, despite the rapid and intense development of EBM theory, implementation has languished, and many implemented or proposed EBM schemes largely ignore the special characteristics of regime shifts. Here we first explore key aspects of regime shifts that are of critical importance to EBM, and then suggest how regime shifts can be better incorporated into EBM using the concept of Integrated Ecosystem Assessment (IEA). An IEA uses approaches that determine the likelihood that ecological or socio-economic properties of systems will move beyond or return to acceptable bounds as defined by resource managers and policy makers. We suggest how to apply IEAs for regime shift cases of avoiding an undesired and returning to a desired state. We discuss the suitability and shortcomings of methods summarizing the status of ecosystem components, screening and prioritizing potential risks, and evaluating alternative management strategies.
Publication date: Summer 2014